

Plant Roots: Manipulating Plant Root Systems for Improved NUE

Nitrogen Use Efficiency (NUE) in plants is predicated upon the complex interactions between plant physiological properties, root architecture and soil biological transformations of N, all operating in the framework provided by the soil pore structure. We aim to understand how particular root traits (e.g. dimensions, depth, branching, proliferation and functioning) affect NUE of specific plants via root-based properties (Bai et al. 2013), focusing on the role of botanical diversity in such systems, and how this may be manipulated via the nature of the rotation. This will involve examining the use of intercropping systems (such as maize with *Clitoria fairchildiana*) and exploring the specific opportunity to introduce additional diversity via multi-species cover crops with complementary belowground functional traits (e.g. mixtures of grasses, legumes, herbs with deep tap-roots or prolific lateralisation). In some systems, *Brachiaria*, a pasture grass (also an aggressive weed), is planted along with soybeans and maize to produce a cover crop after harvest (Freitas et al. 2015). If well managed, the grain crop is not negatively affected by the grass. This would have been considered an agronomic heresy a few years ago but now it is not only working but being increasingly adopted by farmers in Brazil. Such novel approaches to crop management may be transferred to or adapted in other tropical and subtropical regions to enhance the soil N budget.

References:

- Bai et al. (2013). Identification of QTLs associated with seedling root traits and their correlation with plant height in wheat. *J. Exp. Bot.* 64, 1745-53.
- Freitas et al. (2015). Levels of nutrients and grain yield of maize intercropped with signalgrass (*brachiaria*) in different arrangements of plants. *Planta Daninha* 33, 49-56.